

5

WE CLAIM:

1. A method for preparing the skin for treatment of cutaneous or subcutaneous compounds, comprising the steps of:
  - a) focusing a laser beam with sufficient energy fluence to ablate or alter the skin at least as deep as the stratum corneum, but not as deep as the capillary layer;
  - b) firing the laser to create a site of ablation or alteration, the site having a diameter of between 0.5 microns and 5.0 cm;
  - c) applying a dye, a compound that alters the optical properties of stratum corneum, or a compound that stimulates the body's production of molecules that are strong absorbers of light; and
  - d) firing a second laser with a wavelength that is absorbed by the applied dye, the compound that stimulates the optical properties of stratum corneum or the compound that stimulates the body's production of molecules that are strong absorbers of light.
2. The method of claim 1 wherein the laser beam has a wavelength of 0.2 - 10 microns
3. The method of claim 1 wherein the laser beam has a wavelength of between 1.5 - 3.0 microns.
4. The method of claim 1 wherein the laser beam has a wavelength of about 2.94 microns.

5                    5.        The method of claim 1 wherein the laser beam is emitted by a laser selected from the group consisting of continuous wave-lasers Er:YAG, pulsed CO<sub>2</sub>, Ho:YAG, Er:YAP, Er/Cr:YSGG, Ho:YSGG, Er:GGSG, Er:YLF, Tm:YAG, Ho:YAG, Ho/Nd:YalO<sub>3</sub>, cobalt:MgF<sub>2</sub>, HF chemical, DF chemical, carbon monoxide, deep UV lasers, and frequency tripled Nd:YAG lasers.

10                   6.        The method of claim 1 wherein the laser beam is emitted by a modulated laser selected from the group consisting of continuous-wave CO<sub>2</sub>, Nd:YAG, Thullium:YAG and diode lasers.

7.        The method of claim 1 wherein the laser beam is emitted by an Er:YAG laser.

15                   8.        The method of claim 1 wherein the laser beam is focused at a site on the skin with a diameter of 0.1 - 5.0 mm.

9.        The method of claim 1 wherein the energy fluence of the laser beam at the skin is 0.03 - 100,000 J/cm<sup>2</sup>.

20                   10.       The method of claim 1 wherein the energy fluence of the laser beam at the skin is 0.03 - 9.6 J/cm<sup>2</sup>.

11.       The method of claim 1 wherein the pulse width is between 1 femtosecond and 1,000 microseconds.

12.       The method of claim 1 wherein the pulse width is between 1 and 1000 microseconds.

- 5                   13.     The method of claim 1 wherein multiple ablations or alterations are made to prepare the skin for dye delivery.
14.     The method of claim 1 further comprising a beam splitter positioned to create, simultaneously from the laser, multiple sites of ablation or alteration.
15.     The method of claim 14 wherein the beam splitter is selected from a  
10 series of partially silvered mirrors, a series of dichroic mirrors, and a series of beam-splitting prisms.
16.     The method of claim 14 further comprising a means to deflect the beam at different angles to create different sites of ablation alteration on the skin.
17.     The method of claim 14 further comprising a means to scan the laser  
15 beam to create one continuous path of ablation or alteration.
18.     The method of claim 1 wherein the dye is used to stain subcutaneous structures.
19.     The method of claim 1 wherein the dye is indocyanine green.
20.     The method of claim 1 wherein the dye is specific for lipids, proteins,  
20 or carbohydrates.
21.     The method of claim 1 wherein the wavelength of the laser beam fired from the second laser at the site of dye delivery is about the wavelength of peak absorption of the dye.

5                   22.     The method of claim 21 wherein the wavelength of the laser beam is about 810 nm.

                  23.     The method of claim 1 wherein the wavelength of the laser beam fired from the second laser at the site of delivery of the compound that stimulates the body's production of molecules that are strong absorbers of light is about the wavelength of peak  
10   absorption of the compound.

                  24.     The method of claim 23 wherein the compound that stimulates the body's production of molecules that are strong absorbers of light is 5-aminolevulinic acid.

                  25.     A method for increasing the diffusion of bodily fluids out of, or compounds into, the skin, comprising the steps of:

- 15                   a)     applying a compound or an absorbing material to the targeted tissue;
- b)     focusing a laser beam with sufficient energy fluence to create a pressure gradient within the stratum corneum, in the applied compound, or in the optional absorbing material; and
- 20                   c)     firing the laser with at least one short rapid pulse to create the pressure gradient.

                  26.     The method of claim 25 wherein the laser beam has a wavelength of 0.2 - 10 microns.

                  27.     The method of claim 25 wherein the laser beam has a wavelength of  
25   between 1.5 - 3.0 microns.

5                   28.     The method of claim 25 wherein the laser beam has a wavelength of about 2.94 microns.

                  29.     The method of claim 25 wherein the laser beam is emitted by a laser selected from the group consisting of Er:YAG, pulsed CO<sub>2</sub> Ho:YAG, Er:YAP, Er/Cr:YSGG, Ho:YSGG, Er:GGSG, Er:YLF, Tm:YAG, Ho:YAG, Ho/Nd:YAlO<sub>3</sub>, cobalt:MgF<sub>2</sub>, HF  
10 chemical, DF chemical, carbon monoxide, deep UV lasers, and frequency tripled Nd:YAG lasers.

                  30.     The method of claim 25 wherein the laser beam is emitted by an Er:YAG laser.

                  31.     The method of claim 25 wherein the laser beam is emitted by a  
15 modulated laser selected from the group consisting of continuous-wave CO<sub>2</sub>, Nd:YAG, Thallium:YAG and diode lasers.

                  32.     The method of claim 25 wherein the pulse width is between 1 femtosecond and 1,000 microseconds.

                  33.     The method of claim 25 wherein the pulse width is between 1 and  
20 1000 microseconds.

                  34.     The method of claim 25 wherein the optional absorbing material is placed on or over the targeted tissue before application of the compound or firing the laser.

                  35.     The method of claim 34 wherein the pressure gradient is created in the optional absorbing material.

5                    36.    The method of claim 34 wherein the optional absorbing material is a thin films of water.

                  37.    The method of claim 34 wherein the optional absorbing material is a dye or a solution with a dye.

                  38.    The method of claim 25 wherein the compound is applied before  
10   firing the laser.

                  39.    The method of claim 25 wherein the pressure gradient is created in the stratum corneum simultaneous with the application of the compound.

                  40.    The method of claim 38 wherein the pressure gradient is created in the compound.

15                  41.    The method of claim 38 wherein the optional absorbing material is placed on or over the compound before firing the laser.

                  42.    The method of claim 41 wherein the pressure gradient is created in the optional absorbing material.

                  43.    The method of claim 41 wherein the optional absorbing material is a  
20   thin film of water.

                  44.    The method of claim 25 wherein multiple pulses are used to create the pressure gradient.

                  45.    The method of claim 25 wherein the stratum corneum is ablated or altered before the pressure gradient is created.

5                   46.     A method for increasing the diffusion of bodily fluids out of, or  
compounds into, the skin, comprising the steps of:

                  a)     focusing a laser beam with sufficient energy fluence to create  
plasma within the stratum corneum or in an optional absorbing material on or  
over the targeted tissue;

10                   b)     firing the laser with at least one short rapid pulse to create a  
site of plasma, the site having a diameter of between 0.5 microns and 5 mm;  
and

                  c)     removing bodily fluids from the targeted tissue or applying a  
compound to the targeted tissue.

15                   47.     The method of claim 46 wherein the laser beam has a wavelength of  
0.2 - 10 microns.

                  48.     The method of claim 46 wherein the laser beam has a wavelength of  
between 1.5 - 3.0 microns.

                  49.     The method of claim 46 wherein the laser beam has a wavelength of  
20     about 2.94 microns.

                  50.     The method of claim 46 wherein the laser beam is emitted by a laser  
selected from the group consisting of Er:YAG, pulsed CO<sub>2</sub> Ho:YAG, Er:YAP, Er/Cr:YSGG,  
Ho:YSGG, Er:GGSG, Er:YLF, Tm:YAG, Ho:YAG, Ho/Nd:YAlO<sub>3</sub>, cobalt:MgF<sub>2</sub>, HF  
chemical, DF chemical, carbon monoxide, deep UV lasers, and frequency tripled Nd:YAG  
25     lasers.

5                    51.     The method of claim 46 wherein the laser beam is emitted by an Er:YAG laser.

                  52.     The method of claim 46 wherein the laser beam is emitted by a modulated laser selected from the group consisting of continuous-wave CO<sub>2</sub>, Nd:YAG, Thallium:YAG and diode lasers.

10                  53.     The method of claim 46 wherein the pulse width is between 1 femtosecond and 1,000 microseconds.

                  54.     The method of claim 46 wherein the pulse width is between 1 and 1000 microseconds.

                  55.     The method of claim 46 wherein multiple pulses are used to create  
15 multiple sites of plasma.

                  56.     The method of claim 46 wherein plasma is created in the stratum corneum.

                  57.     The method of claim 46 wherein the optional absorbing material is placed on or over the targeted tissue before firing the laser.

20                  58.     The method of claim 57 wherein plasma is created in the optional Absorbing material.

                  59.     The method of claim 57 wherein the optional absorbing material is a thin film of water.



5                   60.     The method of claim 57 wherein the optional absorbing material is a  
dye or a solution with a dye.

                  61.     The method of claim 46 wherein the compound is applied before  
firing the laser.

                  62.     The method of claim 61 wherein plasma is created in the applied  
10   compound.

                  63.     A method for increasing the diffusion of bodily fluids out of, or  
compounds into, the skin, comprising the steps of:

                  a)     focusing a laser beam with sufficient energy fluence to create  
cavitation bubbles in the stratum corneum, in an applied compound, or in an  
15   optional absorbing material;

                  b)     firing the laser with at least one short rapid pulse to create a  
site of cavitation bubbles, the site having a diameter of between 0.5 microns  
and 5 mm; and

                  c)     removing bodily fluids from the targeted tissue or applying a  
20   compound to the targeted tissue.

                  64.     The method of claim 63 wherein the laser beam has a wavelength of  
0.2 -10 microns.

                  65.     The method of claim 63 wherein the laser beam has a wavelength of  
between 1.5 - 3.0 microns.

5                   66.     The method of claim 63 wherein the laser beam has a wavelength of about 2.94 microns.

                  67.     The method of claim 63 wherein the laser beam is emitted by a laser selected from the group consisting of Er:YAG, pulsed CO<sub>2</sub> Ho:YAG, Er:YAP, Er/Cr:YSGG, Ho:YSGG, Er:GGSG, Er:YLF, Tm:YAG, Ho:YAG, Ho/Nd:YAlO<sub>3</sub>, cobalt:MgF<sub>2</sub>, HF  
10 chemical, DF chemical, carbon monoxide, deep UV lasers, and frequency tripled Nd:YAG lasers.

                  68.     The method of claim 63 wherein the laser beam is emitted by an Er:YAG laser.

                  69.     The method of claim 63 wherein the pulse width is between 1  
15 femtosecond and 1,000 microseconds.

                  70.     The method of claim 63 wherein the pulse width is between 1 and 1000 microseconds.

                  71.     The method of claim 63 wherein the laser beam is emitted by a modulated laser selected from the group consisting of continuous-wave CO<sub>2</sub>, Nd:YAG,  
20 Thallium:YAG and diode lasers.

                  72.     The method of claim 63 wherein multiple pulses are used to create multiple sites of cavitation bubbles.

                  73.     The method of claim 63 wherein cavitation bubbles are created in the stratum corneum before firing the laser.

5                   74.    The method of claim 63 wherein the optional absorbing material is placed on or over the targeted tissue before firing the laser.

75.    The method of claim 74 wherein the cavitation bubbles are created in the optional absorbing material.

76.    The method of claim 74 wherein the optional absorbing material is a  
10 thin film of water.

77.    The method of claim 74 wherein the optional absorbing material is a dye or a solution with a dye.

78.    The method of claim 63 wherein the compound is applied before firing the laser.

15               79.    The method of claim 78 wherein the cavitation bubbles are created in the applied compound.

80.    A laser device for ablating or altering skin comprising:

- a)    a lasing element which emits a beam at a wavelength of between 0.2 microns and 10 microns;
- 20       b)    a power source;
- c)    a high voltage pulse-forming network linked to the power source;
- d)    a means for exciting the lasing element, linked to the pulse-forming network;
- 25       e)    a laser cavity; and

5                            f)        a marking means which marks the site of ablation or  
alteration.

81.        The device of claim 80 wherein a disposable safety tip contains a  
pigment and the site of ablation or alteration is marked by the pigment.

82.        The device of claim 80 wherein a pigment is sprayed at the site of  
10    ablation or alteration.

83.        The device of claim 80 wherein the site of ablation or alternation is  
marked before firing the laser.

84.        The device of claim 80 wherein the site of ablation or alteration is  
marked after firing the laser.